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ABSTRACT

Designed to help vocational teachers aid students in reading vocational education class materials, this handbook contains six sections of background information and suggested activities geared to various aspects of reading and a section of ideas for use in improving the reading skills of vocational students. While most of the examples in the handbook were derived from industrial mechanics classes, they can be used in any vocational class. The basic reading skills required in vocational programs are listed. Discussed next are using standardized test scores, constructing informal reading inventories (IRIs), choosing reading passages and developing questions, and giving and scoring an IRI. Guidelines are given for assessing the reading level of textbooks. Described next are various methods for teaching vocabulary, including using vocabulary scans, structured overviews, illustrations, glossaries, crossword puzzles, and abbreviations. A guided reading plan overview, instructions for implementing such a plan, and a study guide are presented. Included in a section on study skills are discussions of taking notes; interpreting charts, graphs, and schematics; and using cross references and conversion tables. A holistic approach to learning and whole brain activities are explained. (MN)

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ED209499

A METHODOLOGY FOR READING SKILL IMPROVEMENT

IN

VOCATIONAL SECONDARY PROGRAMS

Developed

by

Salem School District

and

Vocational Technical Education Division

School of Education

Oregon State University

in cooperation with

Oregon Department of Education

U.S. DEPARTMENT OF EDUCATION
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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CE 030 528

June 1981

PREFACE

This handbook was developed to help the vocational teacher help students do a better job of reading the things students must read to be successful in vocational classes. Most of the examples in the handbook were derived from industrial mechanics classes. However, the procedures explained here can and will work in any vocational class.

The Salem School District and the Vocational-Technical Education division at Oregon State University worked together to develop and test the ideas in this handbook. This effort was made possible through a grant from the Oregon Department of Education.

Our goal was not to make a reading teacher out of you, but to give you some very practical assistance in working with your students. The ideas in this handbook have worked for the teachers who have tried them. We sincerely hope that you will find these ideas useful.

Wanda Martin
Bill Harp
Bill Wright
Tom Warren
Debbie Crinzi

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ORIENTATION TO THE HANDBOOK

PURPOSE OF THE HANDBOOK

- The purpose of this handbook is to help vocational teachers promote the development of student reading skills in cluster programs.

HANDBOOK ORGANIZATION

- The Handbook is divided into seven major sections.
- The first six sections are organized around two major headings: the topic and background information, which includes suggested activities/resources.
- The last section contains ideas to enrich your efforts to improve reading skills of vocational students.

HOW TO USE THE HANDBOOK

- First, review the table of contents and identify those sections you wish to read.
- Second, locate the topic and read the background information.
- Third, consult the enrichment activities for further ideas.

TOPIC: Basic Reading Skills Required in Vocational Programs

INFORMATION: In order for students to make good progress in vocational programs, teachers should consider the following questions:

- Students: How Well Do They Read?
- Textbooks: How Hard Are They To Read?
- Reading: How Do You Guide It?
- Vocabulary: How Do You Teach It?
- Study Skills: How Can You Use Them?
- Learning: How Many Ways Are There?

1

BASIC READING SKILLS REQUIRED IN VOCATIONAL PROGRAMS

COMMENTS

In order to make good progress in vocational programs, students must be able to do the following:

- Use a technical vocabulary (including abbreviations and symbols)
- Interpret charts, graphs, schematics, illustrations and tables
- Follow written directions
- Recall specific information
- Make inferences (explain)
- Apply knowledge and skills in a practical situation
- Analyze a situation (troubleshooting, determining cause and effect)

METHODS

How Well Do Students Read?

- Standardized Tests
- Informal Reading Inventory (IRI)
- Sample Passage

How Hard Are Textbooks to Read?

- Rule of Thumb
- SMOG Procedure

How Do You Teach Vocabulary?

- Using Vocabulary Scan
- Using Structured Overviews
- Define/Illustrate
- Using Glossaries
- Using Crossword Puzzles

- Using Abbreviations
- Vocabulary Ideas

How Do You Guide Reading?

- Guided Reading Plan
- Study Guide

How Can You Use Study Skills?

- Notetaking
- Charts, Graphs, Tables, etc.
- Cross References
- Conversion Tables

How Many Ways Are There?

- A Holistic Approach to Learning
- Whole Brain Activities
- Book List/Other Resources

These skills can be developed or enhanced in vocational programs. Suggested means for developing these skills are described in subsequent sections of the handbook. Still other methods are included in the final section titled "Enrichment Activities."

Application of these activities in the vocational programs will help students master the basic reading skills required by cluster programs.

TOPIC: Students: How Well Do They Read?

INFORMATION: There are two ways to assess reading skills of students in the classroom.

- Standardized Testing
- Informal Reading Inventory (IRI)
- Sample Passage

STANDARDIZED TEST SCORES

METHOD — Standardized test scores can be gained from test information already in the student file or from the classroom. Some recommended short, easily used tests are as follows:

- Wide Range Achievement Test (WRAT)
- McGrath Test of Reading Skills
- Gates McGinitie Reading Tests

COMMENTS — Counselor and school reading teachers all have tests available that may be used in the classroom.

INFORMAL READING INVENTORY

METHOD — An Informal Reading Inventory can be used when the teacher wants to find out if a student can work with a reading text. The steps to use in making an IRI are as follows:

STEPS	INFORMATION	DETAILS
Choose a Section of Reading		
Develop Questions	8-10 Questions	
	Sequence Questions by Placement in Text Different Types of Questions	Vocabulary Literal Interpretation Inference Application
Give IRI		
Score IRI	Determine % Correct of Total Questions	Independent 90% Instructional 70% Frustrational 50%

INFORMAL READING INVENTORY (IRI) - CHOOSE A SECTION OF READING

INSTRUCTION

Choose a section of reading that can easily be accomplished within five to ten minutes. If the selection takes more than ten minutes those students with low reading skills and short attention spans have an opportunity to disrupt the classroom. The reading material chosen should contain material they are unlikely to know.

EXAMPLE

The section of reading comes from "How The Engine Operates," pp. 72-73, The Auto Book, Second Edition, William H. Crouse and Donald L. Anglin, 1979, McGraw-Hill, Inc.

Sample Passage

HOW THE ENGINE OPERATES

Now we are ready to learn how the engine works. First, one of the valves opens to let the air-fuel mixture into the cylinder. Later, the other valve opens to let the burned gases out. Let's follow the cycle of events all the way through.

A *cycle* is a series of events that repeat themselves. For example, the four seasons—spring, summer, fall, and winter—form a cycle. In an engine, the four-stroke cycle includes the intake stroke, the compression stroke, the power stroke, and the exhaust stroke.

8-11 THE INTAKE STROKE

First, the piston moves down, as shown in Fig. 8-15. As the piston moves down, it produces a vacuum in the cylinder. A *vacuum* is the absence of air or any other substance. Outside air rushes in to fill the vacuum. The same thing happens, for example, when you take in a drink through a straw. You move your jaw down to produce a vacuum in your mouth. Air tries to get in to fill the vacuum. But, instead, the drink gets in the way, and the air pushes the drink up the straw and into your mouth.

During this piston stroke, one of the valves—the intake valve—is open. The valve is down off its seat, and the air-fuel mixture fills the vacuum produced by the downward movement of the piston. This downward movement of the piston is called the *intake stroke* because the cylinder is taking in a mixture of fuel and air. As the air moves toward the cylinder, it first has to pass through the carburetor. The *carburetor* sits on top of the engine and mixes gasoline vapor with the air passing through. Carburetor actions are explained in Chap. 18.

The piston moves all the way down to BDC on the intake stroke. The intake valve is open, and the air-fuel mixture pours into the cylinder. At the end of the intake stroke, the intake valve closes. We will find out later what makes the valve close.

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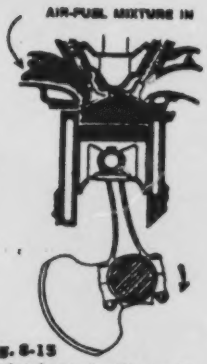


Fig. 8-15
The intake stroke. The intake valve, at left, has opened. The piston is moving downward, drawing air and gasoline vapor into the cylinder.

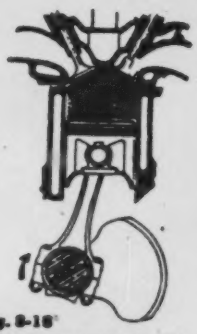


Fig. 8-16
The compression stroke. The intake valve has closed. The piston is moving upward, compressing the mixture.

8-12 THE COMPRESSION STROKE

After the piston passes BDC at the end of the intake stroke, it starts to move up. Both valves are closed, so the air-fuel mixture has no place to go. It is pushed, or *compressed*, into a smaller volume (Fig. 8-16). The amount that the mixture of air and gasoline vapor is compressed is called the *compression ratio*.

In a modern engine, the air-fuel mixture is compressed into one-eighth or one-ninth of its original volume. That is like taking 1 quart of air and squeezing it down to less than ½ cup (Fig. 8-17).

If you squeezed the mixture from 1 quart to ½ cup, you would have a compression ratio of 8:1. There are 8 half-cups in 1 quart. When you compress the quart, which is 8 half-cups, into 1 half-cup, you have gone from 8 down to 1. That is, you have compressed the mixture down from 8 to 1. So, the compression ratio is 8 to 1. Usually, the ratio is shown as 8:1. You read this as "8 to 1."

We will discuss compression ratio again in Chap. 9. But first we will go through the rest of the piston actions. The piston moves up from BDC to TDC, compressing the mixture. This stroke is called the *compression stroke*.

8-13 THE POWER STROKE

As the piston nears TDC at the end of the compression stroke, a spark occurs in the top of the cylinder. The spark plug makes the spark (we will find out how this happens later). When a spark occurs in the compressed air-fuel mixture, there is an explosion. The pressure and temperature of the mixture suddenly go up. Every square inch of the piston head gets a push of up to 600 pounds [270 kg] or more. This adds up to as much as 2 tons—4000 pounds [1814 kg]—pushing down on the piston head! That is hundreds of pounds more than the weight of the whole New York Jets football team! See Fig. 8-18. It is easy to understand why the piston moves!

The 2-ton [1814-kg] pressure pushes the piston downward. This downward movement is called the *power stroke* (Fig. 8-19). The powerful push on the piston is carried through the connecting rod to the crank on the crankshaft. The crankshaft turns this downward movement into rotary motion. Then the rotary motion is carried through the gears and shafts to the car wheels so that the car moves.

INFORMAL READING INVENTORY (IRI) - DEVELOP QUESTIONS

INSTRUCTIONS — Write questions that measure different types of reading skills such as vocabulary, recall and inference. Include one activity that measures application in a hands-on experience.

DEFINITION ONE — Vocabulary question: ask students to define and/or illustrate technical terms presented before they read, or new terms that were presented and defined in the text.

DEFINITION TWO — Recall questions: ask students to recall isolated pieces of information, sets of information, or sequences of information stated explicitly by the author. The proof of the answer to a recall question can be found in exact words of the author.

DEFINITION THREE — Inference question: ask students to "read between the lines," to draw conclusions that are not specifically stated by the author.

DEFINITION FOUR — Application question: ask students to apply what they have learned from their reading to a different example from that used in the text. Then maximize their knowledge by doing a worksheet, using a model, or working in the lab.

EXAMPLE — The Questions come from "How the Engine Operates," pp. 72-73, The Auto Book, 1979.

How The Engine Operates

1. What does the word cycle mean in this selection? (vocabulary)
2. Where does the piston go on the intake stroke? (recall)
3. List the three engine strokes that you read about? (recall)

4. What happens when a vacuum is made on the intake stroke? (recall)

5. Why can't the power stroke immediately follow the intake stroke? (inference)

6. What happens to the air-fuel mixture during the compression stroke? (inference)

7. What happens when a spark occurs just before the power stroke? (recall)

8. Why is Power Stroke a good name for the power stroke? (inference)

9. What does the crankshaft do? (recall)

10. Go to the instructor and set the model piston at TDC. (application)

ANSWERS

1. A series of events
2. Down toward the bottom of the cylinder
3. a. Intake stroke, b. Compression stroke, c. Power stroke
4. The air-fuel mixture fills the vacuum
5. They are both going down
6. It is compressed
7. The air-fuel mixture explodes
8. Because the explosion of air-fuel mixture pushes the piston down and powers the crankshaft
9. Turns the downward movement of the piston into rotary motion to move the wheels of the car
10. application

INFORMAL READING INVENTORY (IRI) - GIVE IRI

METHOD

1. Explain to your students that you are going to have them read a short selection from their text and then answer some questions. Tell them that the purpose for this is for you to know how well they can read and understand the text so that you will know how to help them use the book during the course.

2. Define the terms used from the selection that they may not know from previous readings.

3. Tell them to read the selection and give them a reason for reading it.

4. Distribute the questions that you have previously written and ask the students to write their answers.

INFORMAL READING INVENTORY (IRI) - SCORE IRI

METHOD

Determine the percent each student has correct by dividing the number correct by the total number of questions.

Independent Level	90%
Instructional Level	70%
Frustration Level	50%

Those students on an independent level will have no trouble reading the text without any teacher assistance. Those on an instructional level can read the text with some teacher help. Those students on a frustration level will have difficulty reading that particular text.

SAMPLE PASSAGE

PROCEDURE

The section of reading comes from "How the Engine Operates," pp. 72-73, The Auto Book, Second Edition, William H. Crouse and Donald L. Anglin, 1979, McGraw-Hill, Inc.

SAMPLE PASSAGE

1. Explain to the students that they will read the selection on page 72-73 of The Auto Book.

2. Define the terms BDC and TDC (These are used in the selection but were defined by the authors in an earlier section.

3. Tell them to read the selection to find out three steps in the operation of an engine.

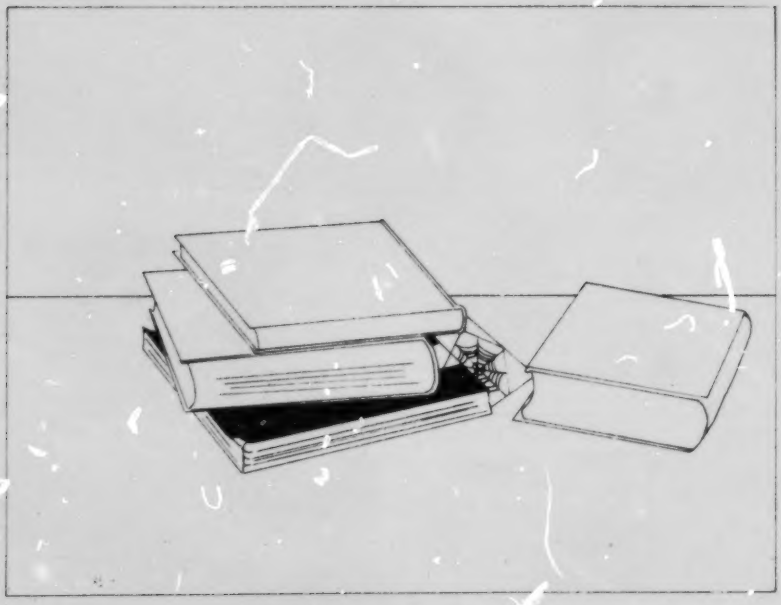
4. Distribute the questions and ask the students to write their answer to each question with the book closed.

5. Score the questions and determine the independent, instructional or frustration level of the student with the text.

COMMENTS

The selection of reading material and questions for this sample passage is located earlier in this section on page 4.

TOPIC: Textbooks: How Hard Are They to Read?



INFORMATION: There are two ways to find out how hard your textbook is to read.

- Rule of Thumb
- SMOG

RULE OF THUMB: MATERIALS/STUDENT ASSESSMENT

METHOD

1. Measure half the space between an outstretched thumb and crooked forefinger onto a reading passage in the textbook.

2. Ask the student to read the section aloud.

3. Each time the student misses a word or pronounces it wrong bend one of the fingers on your hand in sequence beginning with the little finger.

4. If the student misses enough words so you bend your thumb before the passage is completely read, the book is too difficult.

COMMENTS

This type of assessment only measures whether a book is too difficult for a student to read without assistance. This gives a rough estimate of the student's reading ability.

SMOG: TESTS FOR GRADING LEVEL OF TEXTBOOKS

PROCEDURE

1. Count consecutive sentences (a sentence is any string of words ending with a period, question mark or exclamation point).

   Ten (10) near the beginning of the text
   Ten (10) in the middle of the text
   Ten (10) near the end of the text

2. Count every word of three or more syllables found in the thirty selected sentences.

   Any string of letters or numerals beginning and ending with a space or punctuation mark should be counted if you can distinguish at least three syllables when you read it aloud in context.

3. Estimate the square root of the words with three or more syllables that were counted.

   Take the square root of the nearest perfect square.

   If the count lies roughly between two perfect squares choose the lowest number.

4. Add three (3) to the approximate square root.

   This number gives the SMOG Grade.

   This is the reading grade a person must have reached if he or she is to fully understand the book.

COMMENTS

If you use the steps in the SMOG Grading procedure you can find out what reading level the student must have reached if he or she is to fully understand the text used.

TOPIC: Vocabulary: How Do You Teach It?

INFORMATION: This packet contains ideas and suggestions the teacher can use to help students build vocabulary skills while teaching specific content. These include the following techniques:

- Using Vocabulary Scan
- Using Structured Overviews
- Define/Illustrate
- Using Glossaries
- Using Crossword Puzzles
- Using Abbreviations
- Vocabulary Ideas

USING A VOCABULARY SCAN

COMMENTS — Vocabulary is the key to reading; it must be given to the student before the reading is assigned. A vocabulary scan by the student for unfamiliar technical words or teacher-directed vocabulary preview are effective methods for preliminary reviews. Classroom vocabulary work where students work in small groups and share word concepts and definitions is another good vocabulary preview.

DEFINITION — A Vocabulary Scan by the student involves looking for unfamiliar words in an assigned reading.

PROCEDURE — Students will scan quickly through a reading assignment.

1. Look for specific words that are given as a vocabulary
2. Gain a general understanding of its definition by reading the sentence in which it is placed.

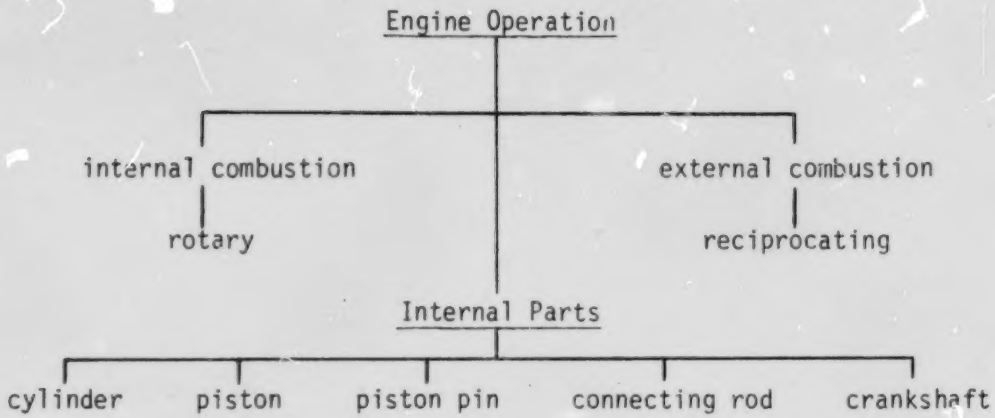
USING STRUCTURED OVERVIEWS

COMMENTS — Structured overviews are a good way to teach vocabulary at the same time the teacher explains the daily lesson. The teacher draws a diagram on the chalkboard showing the relation of vocabulary words to each other. This way the vocabulary words can be used to tie the lesson together.

DEFINITION — A Structured Overview is a diagram showing the relationship of vocabulary words to each other.

PROCEDURE — On a chalkboard or on butcher paper the teacher will present and define terms organized as details under main headings.

EXAMPLE — Arrange the vocabulary words relating to the engine according to its operation and its internal parts, as you explain these words to your students.



DEFINE/ILLUSTRATE

METHOD — Define/Illustrate is an activity used to help students more quickly learn new concepts by defining and illustrating the vocabulary words.

PROCEDURE — Lead a student discussion beginning by "defining" the new vocabulary work, using student language and then illustrate it through some visual means such as chalkboard, overlay, actual item, a hand-out, etc.

USING GLOSSARIES

COMMENT Using appropriate glossaries is important in building the students' vocabulary. Glossaries that contain definitions which themselves need to be defined are inappropriate for vocabulary work and need to be redeveloped.

DEFINITION A glossary is a list of words in the text that are important for learning "trade talk" and the definitions of important vocabulary.

PROCEDURES Teachers should review the definitions given in the textbook glossaries. If the definitions are too hard or unclear you may have to write your own glossary.

EXAMPLE The following are good definitions and poor definitions of technical vocabulary.

FUELS

Good	Poor
1. Flash Point: The temperature at which a fuel will flash and burn.	The flash-point of an oil or fuel is the temperature to which the oil or fuel has to be heated until sufficient flammable vapor is given off to flash when brought into contact with a flame.
2. Detonation: A fuel charge firing or burning too violently, almost exploding.	When detonation occurs, unburned gases are compressed ahead of the flame front in the combustion chamber, raising the pressure of such gases and their temperature until the self-ignition point is reached. This causes a knock or "pinging" sound.

3. Atomization: Atomization means breaking a liquid into very tiny particles or droplets.	A breaking down of gasoline by the carburetor to increase the surface area of the fuel to enhance oxidation of fuel mixture during combustion.
4. Compression: Squeezing the air-fuel mixture into a smaller space.	Applying pressure to a spring, or any springy substance, thus causing it to reduce its length in direction of compressing force. Applying pressure to gas, thus causing reduction in volume.
5. Combustion: The rapid burning of the air-fuel mixture in the engine cylinder.	A burning. Chemistry - a chemical change, especially oxidation, accompanied by the production of light and heat.

USING CROSSWORD PUZZLES

DEFINITION Crossword Puzzles link technical terms to vocabulary definitions.

COMMENT Crossword Puzzles can be enjoyable activities to use as extra credit or "time filler" activities. They are a good reinforcement for learning vocabulary in content areas.

PROCEDURES Read the definition of the word that matches boxes in the crossword puzzle. Horizontal boxes have definitions in the "across" section. Vertical boxes will be filled with words with definitions located in the "down" section.

USING CROSSWORD PUZZLES - continued

EXAMPLES

- Basic Automotive
- Advanced Automotive
- Accounting
- What's Cooking

CAREER CROSSWORD

Basic Automotive

DOWN

1. safety harnesses (two words—pl.)
2. helpful kind of truck in an emergency
4. head _____ (or tail _____)
5. spare tire usually stored here
6. license _____
7. to come into sight
8. illegal to drive without
11. negative response
12. A-_____; all right
13. covers lug nuts on wheel (two words)
17. guiding a car in motion
19. a fuel
21. the one in the rear window blower uses electrical power
24. verb meaning to exist
26. burns fuel
27. if you hit a hole in road, you feel a _____
28. river (Span.)
30. scraped and shaped a road surface
34. amount (ab.)
36. instrument indicating quantity of gas (two words)
37. needed to drive at night (two words—sing.)
38. a vegetable
39. Old English (ab.)
40. by way of
42. obstetrics (ab.)
43. front window of auto
46. railroad (ab.)
49. pronoun
50. nickname for 16th U. S. president
51. cools water for the engine
53. should be used before going around a corner (two words)
55. street (ab.)
56. a tone of the music scale
57. top of car
58. preposition
60. used in laying out a travel route
61. opposite of left
62. conjunction used to indicate an alternate
63. skinny
65. doctor (ab.)
67. it increases electrical voltage (a kind of transformer)
71. key inserted in this switch to start car
72. left hand (ab.)
73. a map is handy when you are _____
76. suffix used in forming the comparative of an adjective
78. garden tool
79. that time
81. sainte, French spelling of saint (ab.)
83. titanium (ab.)
88. printer's measure
90. carries water to and from radiator (pl.)
92. a greeting
93. perform a task
95. thus
97. common term for automobile (slang)
98. the reason for having an aerial
100. gymnasium (ab.)
101. emergency tool (preceded by indefinite article)
102. regarding (ab.)
103. sound of a blackbird
105. object placed in ignition switch (pl.)
107. promissory note (ab.)
110. a unit of electric current, slang form (pl.)
111. a type of tall grass
112. conjunction indicating addition
114. color of stoplight
117. moves air through radiator
121. Military Police (ab.)
122. to move
123. conjunction; likewise

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CAREER CROSSWORD

Basic Automotive

ACROSS

1. electric motor used to turn engine over
3. used for radio reception
5. part of exhaust system (two words)
9. car has five of these
10. oil _____
14. toot
15. trip
16. used to stop car
18. mostly carbon oxides, water vapor and unburned gasoline
20. tires are mounted on these
22. used in the rain
23. alternating current (ab.)
25. windshield wiper _____
27. charges and discharges (stores electricity)
29. bucket _____
31. shields eyes from sun
32. adjective, adverb meaning "in the past"
33. to harm finish (of auto)
35. preposition meaning derived from or originating at or from
37. covers engine compartment
41. revolutions per minute (ab.)
42. uttered in pain
44. _____ out; to make (as a living)
45. is done by person "behind the wheel"
47. vehicle with two wheels (slang)
48. accounts receivable (ab.)
49. Northwestern state (ab.)
52. period of time starting from a certain base date
54. certain instrument controls and indicators are mounted here
57. connects piston to crankshaft
59. what fingers are to hands these are to feet (sing.)
60. rear view _____ (reflects)
63. large unit of weight (pl.)
64. contraction of "I had"
66. yes (Span.)
68. Registered Nurse (ab.)
69. part of S. Claus' vocabulary
70. protects radiator
74. "Much _____ About Nothing" (Shakespeare)
75. one of many in a book
77. done to gears
80. a second image on the TV screen
82. part of game of tag
84. hour (ab.)
85. atom or group of atoms with an electrical charge
86. pronoun (masc.)
87. X in Roman numerals
89. traffic signal
91. indicates "number of years old"
92. past tense of verb "to hold"
94. how a man is addressed
96. glass in a car door
99. toward
100. shifting _____
103. radiator _____
104. all right
106. military vehicle with four-wheel drive
108. Southern state (ab.)
109. it houses the family automobile
113. used for entering auto
115. girl's name
116. frozen rain (soft flakes)
118. adult male humans
119. compass direction
120. centimeter (ab.)
122. accelerator (two words)
124. work animal once widely used to pull plows, etc.
125. provides spark for combustion (two words)
126. opposite of under
127. a Mid-western state, two words (ab.)
128. steamship (ab.)

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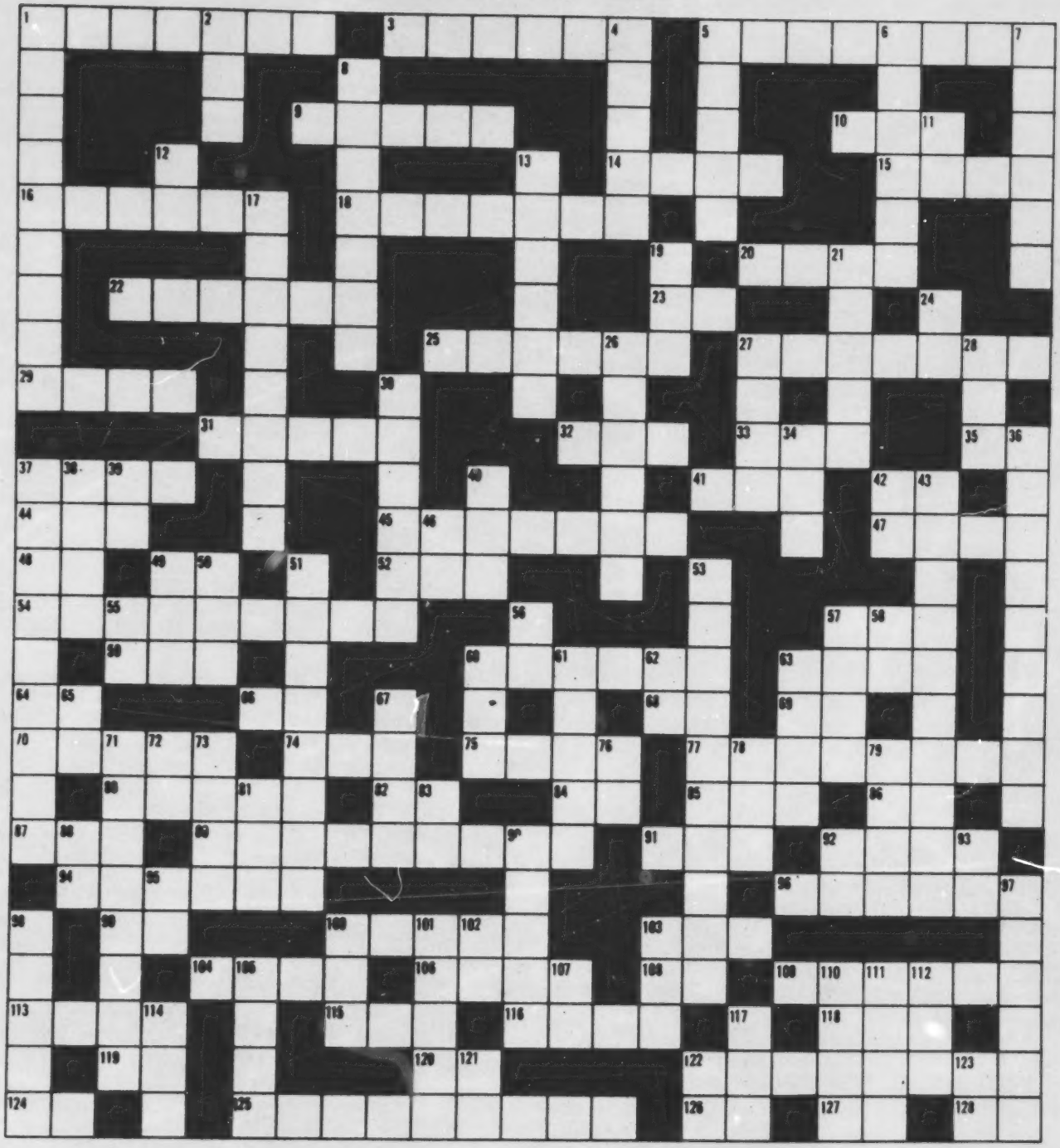
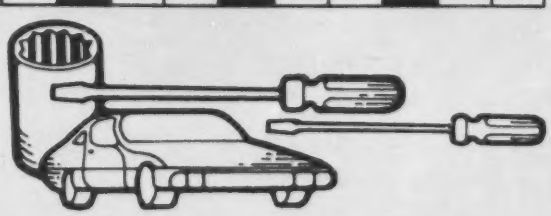
CAREER CROSSWORD



Basic Automotive



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CAREER CROSSWORD

Advanced Automotive

ACROSS

1. No. 10 can do this
4. located between engine and passengers (for safety in case of fire)
10. transportation before auto
11. boy's name (nickname)
13. road (ab.)
14. route (ab.)
16. combustion takes place in (pl.)
18. policeman (slang)
19. adverb; to go _____ (enter)
20. connects driveshaft to rear wheels
23. lubricant
24. expression of satisfaction
25. compass direction
26. regarding (ab.)
28. oil or air goes through this
30. usually carried in trunk
32. conjunction to indicate an alternative
34. before noon
36. mixes fuel with air
40. continent in the Western world (ab.)
41. frozen water
42. musical note
43. pop (for drinking)
44. suffix for changing nouns to adjectives (indicating "made-of")
45. junk _____
48. color meaning "stop"
49. mechanical system connecting gas pedal to carburetor
51. owner's manual should be _____
53. moves up and down in cylinder
55. tells direction
58. to feed or consume
59. symbol for a light weight metal
60. preposition meaning "so as to approach"
61. form of verb "to be"
62. doctor (medical) (ab.)
63. pistons cause this part to turn

DOWN

2. connects piston to crankshaft
3. variation of "though"
4. a scuffle or brawl
5. island (ab.)
6. to _____ brakes (repair)
7. under protection of the courts; or found in a hospital
8. modern equivalent of generator
9. the wheel is mounted on these when a tire is changed
12. quiets exhaust system
13. car body under the doors (an exterior part—two words)
15. horse power (ab.)
16. increases electrical voltage for ignition (a type of transformer)
17. _____ preserver; used to keep afloat in water
20. used to check oil
21. definite article (serves as an adjective)
22. used before words beginning with a vowel (ind. article)
27. to speed up the engine, while standing still
28. carry auto across water
29. a moving part of the distributor
31. radium (abbr.)
33. past tense of verb meaning "to be conveyed by animal or machine"
35. one for intake and one for exhaust
37. engine shafts (and others) rotate in them
38. man-made element named after famous physicist and mathematician (symbol for it)
39. cools water for engine
46. residence (ab.)
47. number on a calendar
50. American Automobile Assn. (ab.)
52. to bring about
54. birds lays eggs in
55. opens and closes valves
56. station (ab.)
57. relationship of boy to father
61. conjunction meaning "In the event that"

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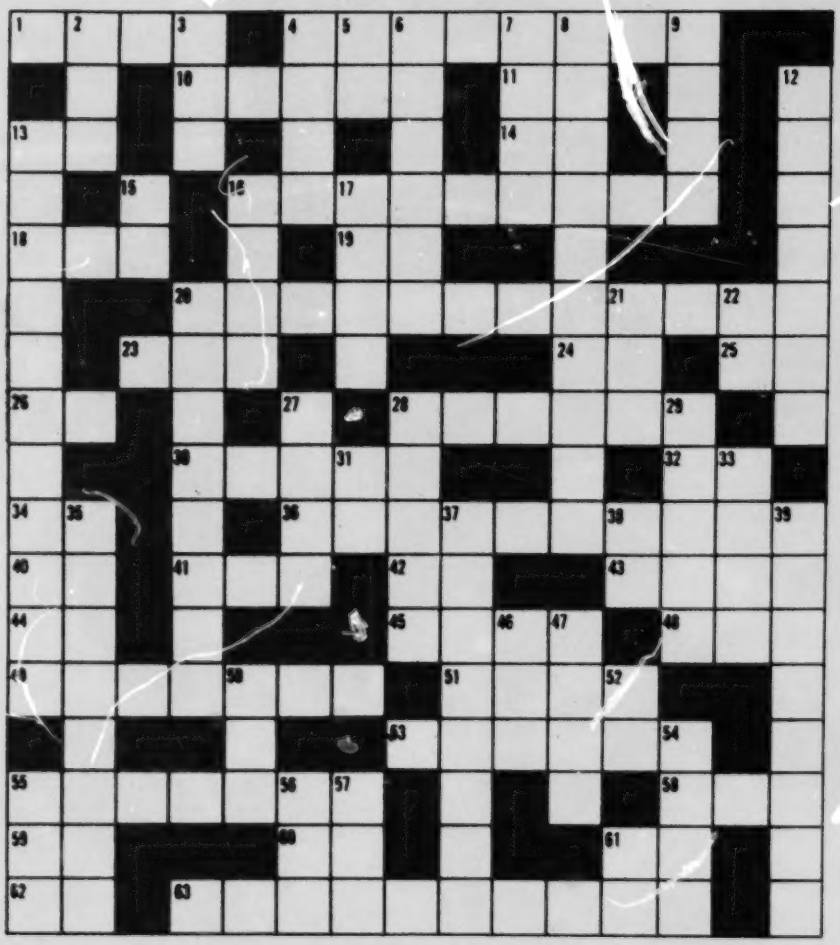
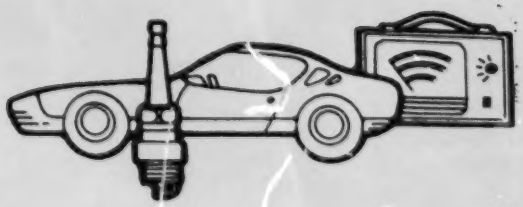
CAREER CROSSWORD



Advanced Automotive



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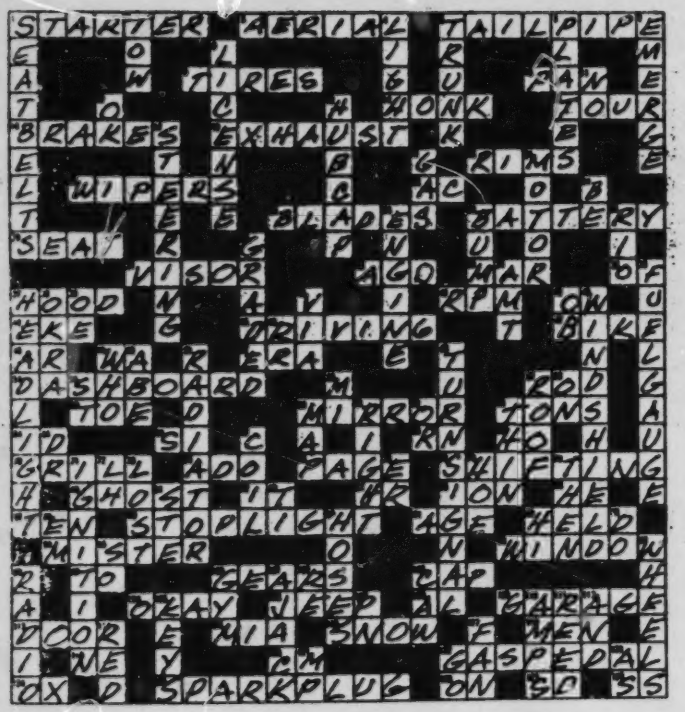
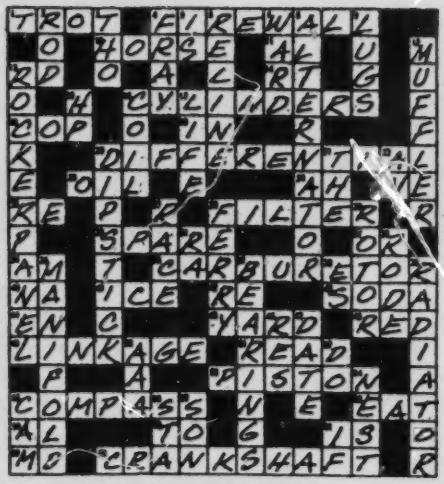
ANSWER KEY TO AUTOMOTIVE CROSSWORD PUZZLES



Basic Automotive



Advanced Automotive

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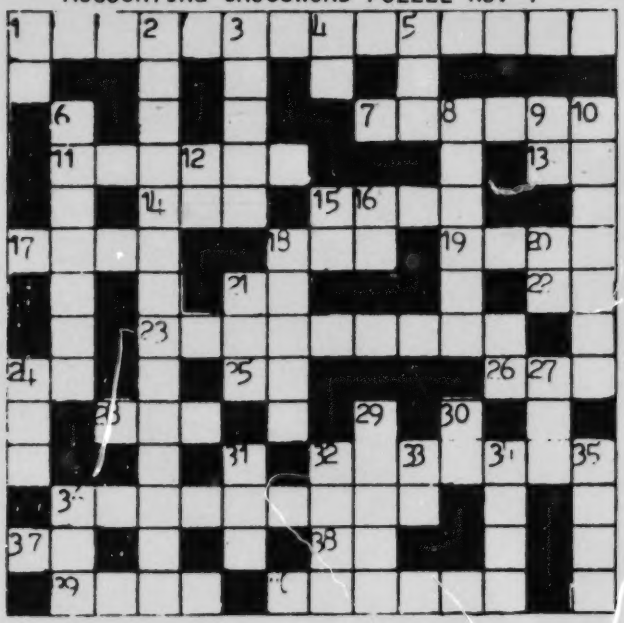
ACCOUNTING CROSSWORD PUZZLE No. 1



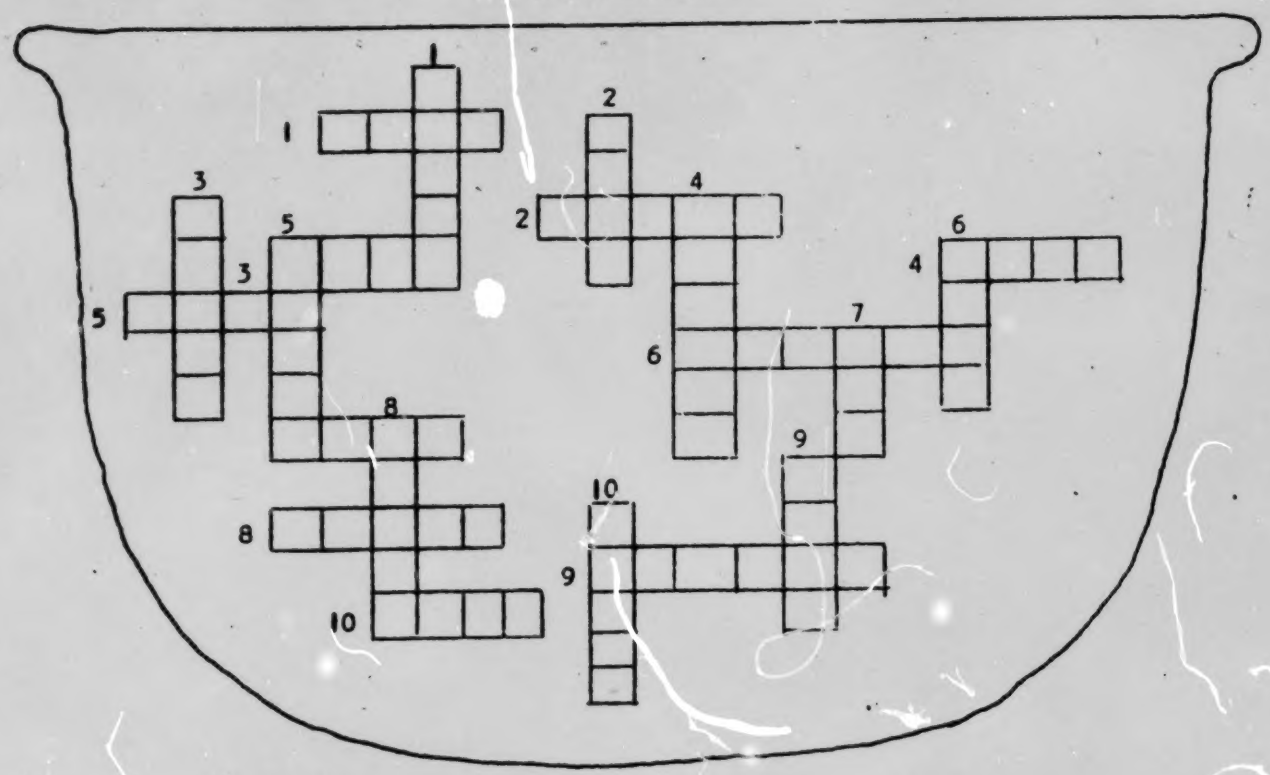
ACROSS

1. The owner's interest in his business
7. Money received from sales and services
11. _____ = Liabilities + Proprietorship
13. A tool used for chopping wood
14. For every debit entry, there must be at least ___ credit entry
15. Past participle of go
17. Physical or mental suffering caused by injury, etc.
18. To put on
19. Finished
21. To exist
22. In contact with, supported by, or covering
23. A debt of a person or business
24. Personal pronoun
25. Seventh note of the musical scale
26. Organ used for seeing
28. To inquire
32. A term the same as Number 1 Across
36. Persons to whom money is owed
37. Louisiana, abbr.
38. Regarding
39. To transfer journal entry information to ledger accounts
40. A file or book of final entry

DOWN

1. Shortened form of father
2. Things of value that a person owns
3. Angry, incensed
4. Toward
5. Past tense of walking very fast
6. The _____sheet follows the bookkeeping equation: A = L + P
8. The right side of an account
9. Colloquial form of mother
10. The telephone bill is an example of an _____.
12. A space half the width of an "em"
15. Opposite of stop
16. Same as 22 across
18. The left side of an account
20. Negative
21. Object used in baseball
24. To injure so as to make imperfect
27. An affirmative statement or vote
29. Looked after
30. Third note of the musical scale
31. A loud, continuous noise
33. Post script
34. A long trip, as for sightseeing
35. Final
36. Head covering

WHAT'S COOKING?



ACROSS

1. Make a mixture smooth by mixing it fast, lifting the mixture with each stroke.
2. Put in oven uncovered to cook by dry heat.
3. Cook in oven.
4. Remove outside covering by stripping it off (as banana)
5. Cook in water or other liquid so that it steams, bubbles, and breaks the surface.
6. Cook food in liquid just below the boiling point.
7. Cut into cubes.
8. Mix by pressing together, folding and stretching.
9. Mix solid fat into dry ingredients by chopping with blender, knives or special forks.
10. Make liquid by heating.

DOWN

1. Moisten food while cooking, usually with a sauce or fat.
2. Cut into small pieces with sharp knife, scissors, chopper.
3. Cook by direct heat either using oven broiler or other coals out-of-doors.
4. Add flavoring - salt, spices, or liquid flavoring.
5. Mix thoroughly two or more ingredients.
6. Remove skin or outer covering by cutting it away (as apples).
7. Combine ingredients by stirring.
8. Beat shortening (or fat and sugar for cakes) until fluffy.
9. Beat rapidly to mix in air and increase volume.
10. Heat milk just below the boiling point.

bake	baste	beat	blend	boil
broil	chop	cream	cut in	dice
knead	melt	mix	pare	peel
roast	scald	season	simmer	whip

USING ABBREVIATIONS

COMMENT Abbreviations are an important part of vocabulary development.

PROCEDURES Make lists of commonly used abbreviations that students need to learn.

- Use for extra credit
- Have available as a filler activity
- Incorporate into a supporting activity for a reading assignment.

H.P.	HORSE POWER
A/C	ALTERNATING CURRENT (POSSIBLY) AIR COND
P.S.I.	POUNDS PER SQ. IN.
RPM D,N, A/C Off	REVOLUTIONS PER MINUTE, DRIVE, NEUTRAL, AIR COND OFF
HC (PM)	HYDRO CARBON
DIST. RPM	DISTRIBUTOR REVOLUTIONS PER MINUTE
9.5 V	9.5 VOLTS
75°	75 DEGREES
.035"	THIRTY FIVE THOUSANDTHS OF AN INCH
KV	KILO VOLT
MIN	MINIMUM
MAX	MAXIMUM
75	75 OHMS OHM IS UNIT OF MEASUREMENT
MFD	MICROFARAD
CU. IN.	CUBIC INCH
C.I.D.	CUBIC INCH DISPLACEMENT
4.2 L	4.2 LITER 4200 C.C. DISPLACEMENT
LBS.	POUNDS
7° B	7 DEGREE BEFORE
3° A	3 DEGREES AFTER
TDC	TOP DEAD CENTER
BTDC	BEFORE TOP DEAD CENTER
ATDC	AFTER TOP DEAD CENTER
FED.	FEDERAL
DIST DEG.	DISTRIBUTOR DEGREES
CALIF.	CALIFORNIA (REFERS TO CALIF. EMISSION EQUIPMENT)
FT./LBS.	FOOT POUNDS "REFERS TO TORQUE"
MAX. VAR.	MAXIMUM VARIATION
RACK AND PIN.	RACK AND PINION (STEERING)
DISC ONLY	DISC BRAKE
W/2 BBL.	WITH TWO BARREL CARBURETOR

VOCABULARY IDEAS

Many vocabulary ideas can be used in helping students learn new words.

COMMENTS

A student needs between ten and twenty exposures to a new word to "make it his own."

- Variety is important to keep the student from getting bored.
- Developing consistent and varied exposures often taxes a teacher's imagination.
- Many ideas need to be collected to help in developing vocabulary study activities.

EXAMPLE

"Vocabulary Ideas," by Julia Keizer, Cottage Grove High School, Cottage Grove, Oregon.

VOCABULARY IDEAS*

Since the student needs between 10 and 20 exposures to a new word to "make it his own," variety in those exposures is important to keep students from becoming bored with vocabulary study. Developing consistent and varied exposures to vocabulary words often taxes a teacher's imagination. Here are some collected ideas to prime the creative pump when developing vocabulary study activities:

1. Ask students to bring in a word they learned over the summer, and tell how they learned it and why it stuck with them. If they "cheat" and get a word from the dictionary...the end result is still the same: acquisition of a new word!

2. Debate two words. Which word can we do without and why? Students who get hot about a word will learn it.

3. Give a vocabulary word written on a 3 x 5 card to each student as they enter the room. The student must learn the word and get it into class discussion smoothly. Others in the class try to spot the word and determine its meaning.

4. Ask students to watch Monday Night Football. Write down a word and sentence that Howard Cosell uses. Discuss, define the word, and determine if he used it correctly. Listen for repetitions of that word.

5. Write a technical report using a given number of vocabulary words correctly.

6. Use vocabulary words at lunch--share the reactions you get with the others in the class.

7. Use the vocabulary words in composition or other class writing assignments. Circle the words with colored pen.

8. Find other words in the same family as a vocabulary word. Analyze differences in meanings.

9. Do crossword puzzles.

10. Play scrabble or other commercial word games (Probe) with vocabulary words.

11. Write or tell a familiar story (such as "Little Red Riding Hood") using vocabulary words.

12. Give the class a term unfamiliar to them such as "volumetric efficiency," "mutual inductance," or "modulate." Working in groups of 4 or 5, they write an authentic-looking dictionary entry for the word, making up a definition, pronunciation, etymology, etc. (Use dictionaries to see how other entries look). Each group writes their "entry" on large sheets of paper which are taped to the wall. The class then decides on which entry is the correct one. (The teacher may either do the correct entry himself or slip the correct information to one group.) When they ask for the correct meaning, tell them to look it up.

13. Choose a new word and use it repeatedly in your class presentations. Make a large poster of the word; have students bring pictures to add to the poster which illustrates the correct meaning of the word.

Complete the following sentences:

1. What did Alice say to Alfred as she badgered him to take her to the dance?
2. Describe a situation in which you felt chagrin...
3. Malign one of your teachers...(no names, PLEASE!)...

*Written by Julia Keizer, Cottage Grove High School, Cottage Grove

TOPIC: Reading: How Do You Guide It?

INFORMATION: In classrooms with a wide range of student reading abilities, teachers need to help students read the assignment. This section includes the following:

- Guided Reading Plan Overview
- Instructions for a Guided Reading Plan
- Study Guide

GUIDED READING PLAN OVERVIEW

COMMENTS: One of the concerns of vocational teachers is how to effectively use a difficult text with students who have reading problems.

METHOD The Guided Reading Plan is a procedure for teaching content material which allows students of different reading levels to be successful in the same classroom.

Steps	Information	Details
Limit Reading Passages	Five minute segments Approximately 150 words per minute	
Pre-Teach Vocabulary	Large group preview session	
Assign Reading	Purpose for reading Pages to be read Reading method to be used	Skim Scan
Discuss Reading	Questions Application Exercises	Vocabulary Recall Inference

COMMENTS It is safe to assume that all of your students will benefit from your guiding the reading of the textbook. Those students who find the text too difficult will benefit from your assistance as they read their text.

INSTRUCTIONS FOR A GUIDED READING PLAN - LIMIT LENGTH OF READING PASSAGE

INSTRUCTIONS Follow the three suggestions for limiting reading assignments:

- Find a natural stopping point in the chapter.
- Identify sections of 750-1000 words.
- Choose a 5-7 minute reading selection.

EXAMPLE Auto Book, "The Crankpin," Chapter 8, section 5

CHAPTER EIGHT AUTOMOTIVE ENGINE OPERATION

After studying this chapter, you should be able to:

1. Explain the various ways in which automotive engines are classified.
2. Describe how the crankshaft and connecting rod convert reciprocating motion to rotary motion.
3. Describe the various valve arrangements used in engines.
4. Explain how the four-cycle engine works.
5. Describe the various types of valve trains.
6. Explain valve timing.

8-1 INTERNAL-COMBUSTION AND EXTERNAL-COMBUSTION ENGINES

There are two kinds of engines: internal-combustion and external-combustion. Internal-combustion engines burn fuel inside the engine. The engines you see in all automobiles are internal-combustion engines.

External-combustion engines burn fuel outside the engine. Steam engines are external-combustion engines. These engines run on steam that is produced by boiling water outside the engine.

8-2 RECIPROCATING AND ROTARY ENGINES

We classify internal-combustion, or IC, engines two ways, according to the *motion* of the internal parts. In the usual automotive engine, the parts reciprocate, or move up and down (Fig. 8-1A). In other engines, such as the Wankel and the turbine, the parts spin, or move in a circular pattern (Fig. 8-1B). The parts that move up and down in automotive engines are called *pistons*. For this reason, reciprocating IC engines are often referred to as *piston engines*.

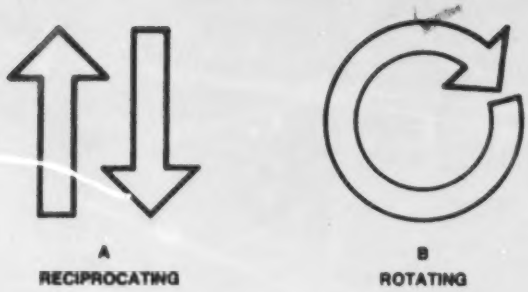


Fig. 8-1
Reciprocating motion is up-and-down or back-and-forth motion as contrasted with rotary (rotating) motion.

8-3 ENGINE CYLINDERS

Pistons move up and down in engine cylinders. Most automobile engines have four, six, or eight cylinders. The same action takes place in each cylinder. We will study just one cylinder to find out how the engine works. Figure 8-2 shows a six-cylinder engine partly cut away so that you can see some of the pistons and cylinders.

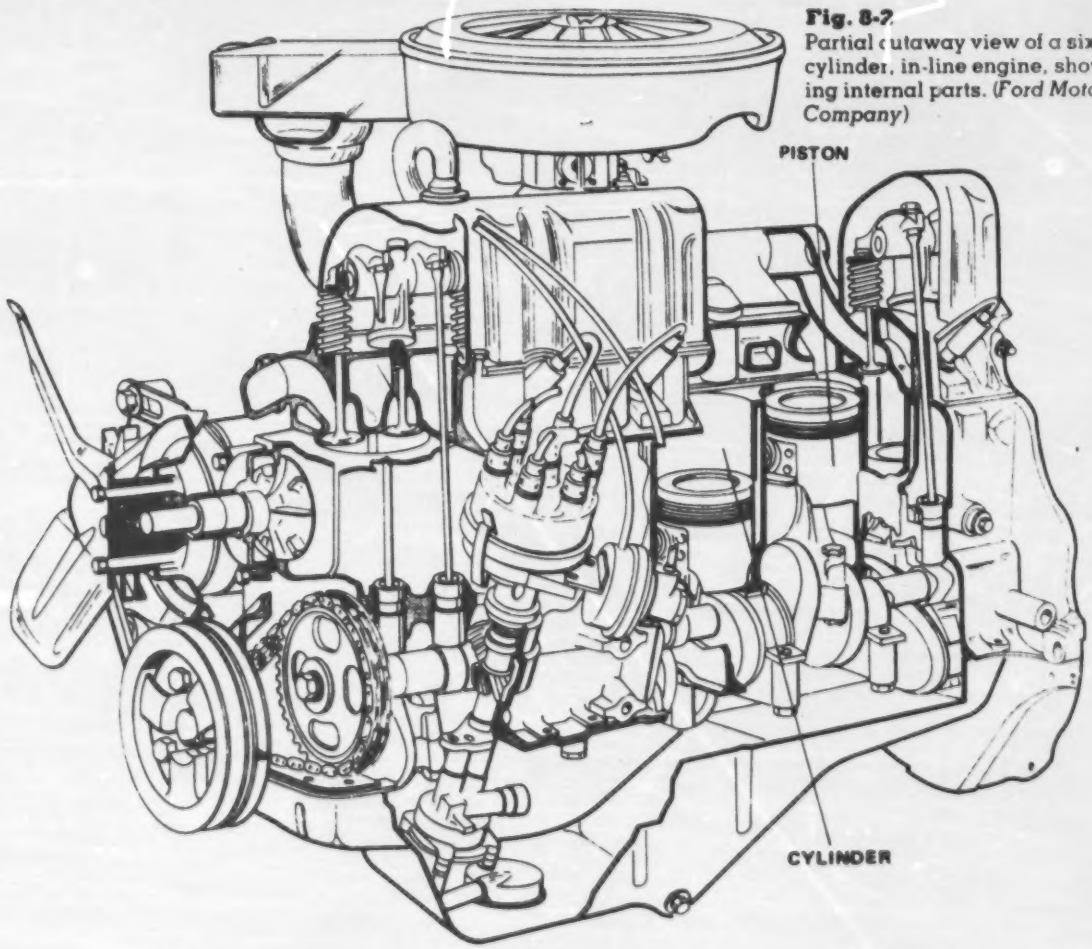


Fig. 8-2
Partial cutaway view of a six-cylinder, in-line engine, showing internal parts. (*Ford Motor Company*)

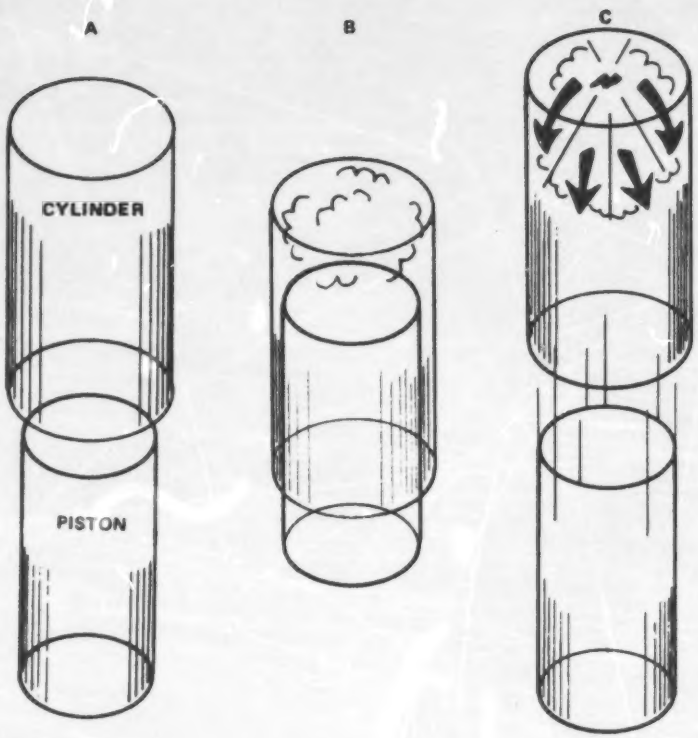


Fig. 8-3
Actions in an engine cylinder. (A) The piston is a metal plug that fits snugly into the cylinder. (B) When the piston is pushed up into the cylinder, trapped air is compressed. (C) If gasoline vapor were mixed with the air and if a spark occurred in the cylinder, the explosion would blow the piston out of the cylinder.

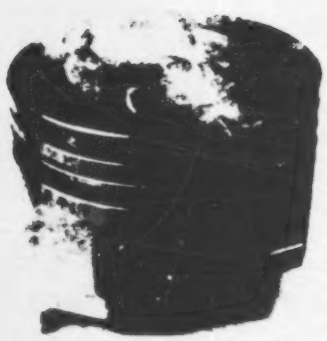


Fig. 8-4
A piston for an engine. (*Ford Motor Company*)

Let us simplify our study by showing only the two parts that interest us now, the cylinder and the piston (Fig. 8-3). What you see in Fig. 8-3 looks like two soft-drink cans, one slightly smaller than the other. The larger can is open at the bottom. The smaller can fits into the larger can, as shown in the middle. If you push the smaller can up into the larger can, you will push or press the air into a smaller volume. That is, you compress the air. Now let's call the cans by their right names. The bigger can is the *engine cylinder*. The smaller one is the *piston*.

When the piston is pushed up into the cylinder, the air in the cylinder is compressed. Suppose there is some gasoline vapor in the compressed air. What would happen if a spark got into the cylinder? There would be an explosion that would blow the piston out of the cylinder, as shown to the right in Fig. 8-3.

8-4 THE CONNECTING ROD AND CRANKSHAFT

Of course, blowing a piston out of a cylinder just once is not enough to make a car move. The piston must move up and down rapidly and remain in the cylinder. Then this up-and-down, or reciprocating, motion must be turned into rotating motion in order for it to rotate the car wheels. The connecting rod and crankshaft do the job of changing the reciprocating motion of the piston into rotary motion.

Figure 8-4 is a picture of a piston. The piston is about 4 inches [100 mm] in diameter and weighs about 1 pound [0.45 kg]. Figure 8-5 shows the piston with the connecting rod attached. Figure 8-6 shows a crank-

shaft. The part of the crankshaft that does the job of changing the reciprocating motion of the piston into the rotary motion of the wheels is called the *crank*. Figure 8-7 shows how the piston, connecting rod, and crankshaft work together. Only part of the crankshaft is shown in Fig. 8-7. The connecting rod is attached to the piston by a piston pin. The piston pin goes through two holes in the piston and one hole in the connecting rod, as shown in Fig. 8-8. The other end of the connecting rod is attached to a crankpin on the crankshaft (Fig. 8-8). This combination changes reciprocating motion into rotary motion.

8-5 THE CRANKPIN

Note how the crankpin swings around the crankshaft in a circle as the crankshaft rotates (Fig. 8-9). During this circular motion, the piston is moving up and down, or reciprocating, as shown in Fig. 8-10.

When the piston moves up and down in the cylinder, the piston, the connecting rod, and the crankpin go through the eight positions shown in Fig. 8-11. The crankpin moves in a circle. The connecting rod tilts first in one direction and then in the other. The lower end of the connecting rod moves in a circle with the crankpin. Study these eight pictures in Fig. 8-11 to see how the up-and-down motion is changed into rotary motion.

NOTE

The crankpin is also called the *crank throw*, or *connecting rod journal*.

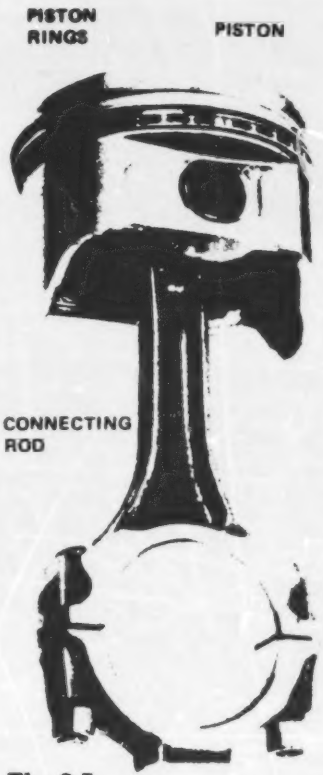


Fig. 8-5
A typical piston with connecting rod attached and piston rings installed. (*Ford Motor Company*)

Fig. 8-6
A crankshaft for a four-cylinder engine. (*Chevrolet Motor Division of General Motors Corporation*)

INSTRUCTIONS FOR A GUIDED READING PLAN - PRE-TEACH VOCABULARY

INSTRUCTIONS

Identify the special, technical vocabulary or "trade talk" that your students must know in order to understand the selection as well as those important illustrations that students often ignore.

EXAMPLE

Technical vocabulary or "trade talk" found in the sample selection that you might introduce are as follows:

- internal-combustion (IC)
- external-combustion
- pistons
- cylinders
- crank
- rotary
- connecting rod
- crankpin

1. When you write internal-combustion on the board, explain or define it as an engine that burns fuel inside the engine. Illustrate this word using the students' own cars as examples.

2. When you write external-combustion on the board, explain or define it as an engine that burns fuel outside the engine. Illustrate this word using a model steam engine.

COMMENTS

You may want to ask students to take notes or keep a vocabulary list in a notebook that they can add to all the time.

INSTRUCTIONS FOR A GUIDED READING PLAN - ASSIGN READING PASSAGES

INSTRUCTIONS

After presenting all of the vocabulary for the reading selection, give the students a purpose or reason for reading the selection. Motivate students to read by picking a statement that will focus their attention on the most important part of the selection.

EXAMPLE "Read to the end of the section called 'The Crankpin' to find out how an engine changes up and down motion into rotary motion."

INSTRUCTIONS Allow time for silent reading of the selection. You may wish to encourage your students to call on you for help with any words they don't know.

INSTRUCTIONS FOR A GUIDED READING PLAN - DISCUSS THE READING

COMMENTS Discuss the selection with students using questions that you make up or find in the text. When you ask questions, try to ask some in each of the categories listed below.

- Vocabulary
- Recall
- Inference
- Application

Each of these kinds of questions are explained in the section for the Informal Reading Inventory.

EXAMPLE ONE Vocabulary questions from the sample selection might include:

- What does reciprocating mean when we are talking about an engine?
- What is an engine cylinder?

EXAMPLE TWO Literal questions from the sample selection might include:

- What are two classifications of internal-combustion engines?
- How many cylinders do most automobile engines have?

- What happens to the air in a cylinder when the piston pushes up?
- What parts of the engine do the job of changing the reciprocating motion of the piston into rotary motion?
- Explain how the engine changes reciprocating motion into rotary motion as you tell what each part does.

COMMENTS — Always be sure to include your purpose for reading the selection in your questions after the reading (see example above).

EXAMPLE THREE — Inference questions from the sample selection might include:

- Why is it important that the piston fit tightly into the cylinder?

COMMENTS — The students demonstrate a deeper understanding of the text when they can answer inference questions.

EXAMPLE FOUR — Application questions from the sample selection might include:

- Given a cut-away engine, show the instructor the parts needed to change reciprocating motion of the piston into rotary motion at the crankshaft.
- Given a multicylinder engine crankshaft, tell your instructor how many crankpins or connecting rod throws are on the crankshaft.

STUDY GUIDE

INSTRUCTIONS — Create a study guide by developing questions in a chronological order which will guide students' reading as they progress through the material.

- Review the different reading skills used when discussing the reading passage.

·Devise questions which ask for different types of reading skills to be used (vocabulary, literal understanding, comprehension, or inference).

EXAMPLE "Read pages 66-69 of the Auto Book and answer these questions."

Study Guide

Section 8-1 Two types of engines are discussed. Which type burns fuel inside the engine?_____

Section 8-2 Read section 8-2 and look at figure 8-1.

1. Which figure shows the action of the Wankel engine?

   _____

2. If a piston moves up and down, what kind of engine would it be?_____

Section 8-3 In the first paragraph 4-6-8 cylinder engines are mentioned. How many cylinders are there in the cutaway drawing figure 8-2?

_____

Paragraph 3:

1. What would the smaller cylinder shown in Figure 8-3 and talked about in paragraph 2 be called?

   _____

2. When the piston is pushed up into the cylinder what happens?

   _____

Section 8-4 What causes the up-down or "reciprocating" motion to rotate the wheels on the auto?_____

Figure 8-5 shows a typical piston. Draw the piston and connecting rod assembly and label the parts.

Figure 8-5 Read section 8-5.

1. Give another name for the crankpin_____.
2. Describe the direction of travel of the crankpin_____
_____

TOPIC: Study Skills: How Can You Use Them?

INFORMATION: It is important for the content area teacher to include necessary study skills into lesson plans. Areas that need classroom instruction are:

- Taking Notes
- Interpreting Charts, Graphs Schematics, Illustrations, etc.
- Cross Reference
- Conversion Tables

STUDY SKILLS: HOW CAN YOU USE THEM?

COMMENTS

To provide study skill instruction you need to plan two phases of activities:

1. Show them how to use the chart, table, index, cross-reference chart, etc., required in your field.

2. Create an opportunity for the students to apply or practice the skill. (Hands on)

TAKING NOTES

Note taking skills should be taught at the beginning of the term. A good note taking system should be simple, flexible, and retrievable.

Descriptor	Information
Simple	The students should be able to understand the organization so that they can use it in any situation which requires notetaking.
Flexible	The students can use it even with poorly organized lectures or written materials.
Retreivable	The student should be able to find pertinent information without rereading all of the notes.

COMMENT — Outlining is not useful with poorly organized lectures or written materials.

EXAMPLE — Three Column Method of Notetaking

PROCEDURES — Teaching students to use the 3-column notetaking procedure.

	SPECIFIC NOTES	COMMENTS
LEFT MARGIN	Draw a verticle line one inch in width on the left of the paper. Use this column for topics of keywords to point out major concepts in the notes.	Notes can be added after the lecture while the important parts are still in mind.
MIDDLE COLUMN	Area from the left margin to within one inch of the right margin. Reserved for taking notes in any manner the student desired (prose, diagram, etc.). Students may take as few notes or as many as fits the material.	Too many notes may distract the student from the material presented.
RIGHT MARGIN	Draw a vertical line one inch from the right hand side. Place comments to self about materials. Place vocabulary words, etc. needing clarified or explained.	Excellent reminder about questions which cannot be asked during notetaking.

INTERPRETING CHARTS, GRAPHS, SCHEMATICS, ILLUSTRATIONS, ETC.

INFORMATION

Interpreting charts, graphs, schematics, illustrations and tables are important skills for vocational students. The teacher must not only teach the student to interpret the visual and symbolic representations, but provide opportunity to use the skill in real-life situations.

COMMENTS

The first step is to develop your students' knowledge of the chart, graph, or table. The second step is to give them a chance to actively use the visual.

PROCEDURES

Teaching students to use charts, graphs, tables, etc.

Step	Information/Activities
1. Use the Visual Resources	Distribute a copy of the text to each student. Show a reproduction or use a large wall chart.
2. Explain the Purpose	Explain the parts of the chart.
3. Find Information in Vertical Column	Explain information found down the left side of the chart.
4. Find Information in Horizontal Column	Explain information found across the top of the chart.
5. Demonstrate the Process	Move from the model in the left column across the chart to the vertical column with the information you need.
6. Practice the Process	Select several pieces of information to locate.
7. Utilize Media	Use the overhead projector. Use a large wall chart. Use pictures.

COMMENTS — Create an opportunity for students to apply or practice the skill once they understand the basic procedures for using the chart.

CROSS REFERENCES

COMMENT — You may need to help your students with the use of cross references. The concern is to develop the students' knowledge of how to use cross references and why they are important, and then give them opportunities to practice using them.

EXAMPLE ONE — Delco "Carburetors, Parts & Power Kits & Emission Control Parts," Vol. 2, 1979-79, pp. 342.

PROCEDURES — Teaching students the process of using cross references.

Steps	Information/Activities
1. Distribute copies of the cross reference	Distribute copies of the manual or copies of the selected page from the manual
2. Use media assistance for large group instruction	Show a transparency of the page on an overhead or show a large wall poster of the cross reference or use other visuals.
3. Explain vocabulary	Define the term cross reference, explain the use of a cross reference chart.
4. Show cross reference approach to different product name	Point out that for any given carburetor, Delco manufactures new and/or rebuilt carburetors, power kits, and overhaul kits.
5. Explain horizontal and vertical columns	Product names are shown across the top of the chart. Carburetor names are shown down the left hand column.

6. Demonstrate the use of cross reference charts	Give several examples of a carburetor number. Locate a part number for a replacement, power kit, or an overhaul kit.

COMMENT — Work through enough examples that you feel confident your students understand how to use the chart.

EXAMPLE TWO — Give students a worksheet or assign a group activity for the following questions:

- If you are working on a carburetor numbered 17065216, what would be the part number of a Delco new replacement? (ans. 22-3187)
- For which carburetor number can get four different rebuilt carburetors from Delco? (ans. 17065027)
- For how many carburetors does Delco offer both new and rebuilt plus both power kits and overhaul (answer 11)

CROSS REFERENCE

CARBURETOR TO — NEW — REBUILT — POWER KIT — OVERHAUL KIT

ROCHESTER

Carb. No.	Replacement		Power Kit	Overhaul Kit
	New	Rebuilt		
17059584	24-3222	—	9371	17065434
17059586	24-3205	—	9370	17065407
17059588	24-3205	—	9370	17065407
17059640	22-3219	—	9386	17065632
17059641	22-3227	—	9386	17065632
17059642	22-3226	—	9386	17065632
17059643	22-3228	—	9386	17065649
17059674	22-6088	—	9387	17065658
17059675	22-6087	—	9387	17065658
17059676	22-6090	—	9387	17065658
17059677	22-6089	—	9387	17065658
17059740	22-3229	—	9386	17065649
17059741	22-3231	—	9386	17065632
17059742	22-3230	—	9386	17065649
17059764	22-3233	—	9386	17065649
17059765	22-3234	—	9386	17065649
17059767	22-3232	—	9386	17065632
17065000	21-3172	—	9357	17055968
17065001	21-3171	—	9357	17055968
17065002	21-3174	—	9357	17055968
17065003	21-3173	—	9357	17055968
17065005	22-1217	—	9338	17055581
17065010	21-3176	—	9347	17065116
17065011	21-3177	—	9347	17065116
17065012	21-3178	—	9347	17065122
17065013	21-3179	—	9347	17065122
17065014	21-3180	—	9347	17065122
17065022	22-3176	12-727, 12-729, 12-730	9267	17050518
17065023	22-1218	12-516, 12-652, 12-685	9245	7046858
17065024	22-1219	—	9245	7046858
17065025	22-6065	12-723	9255	7046748
17065026	22-3173	—	9306	17053997
17065027	22-1220	12-853, 12-854, 12-855, 12-862	9307	17053817
17065028	22-3174	12-520, 12-655	9229	—
17065029	22-6066	12-713, 12-721	9252	7046725
17065121	24-3199	—	9351	17055743
17065133	21-3181	—	9347	17065122
17065134	24-271	—	9346	17065239
17065141	21-3183	—	9323	17065138
17065142	24-5033	—	9319	17055223
17065144	21-3182	—	9323	17055352
17065145	24-5034	—	9319	17065132
17065163	22-1221	—	9338	17065165
17065176	22-593	—	9340	17065167
17065185	22-1222	—	9336	17065193
17065188	22-6067	12-221	9087	—
17065191	21-3188	—	9358	17065184
17065192	22-1223	—	9338	17065165
17065194	21-3189	—	9358	17065184
17065198	22-6088	12-220, 12-390	9087	—
17065200	22-594	12-218, 12-304	9073	—
17065201	22-3178	—	9170	7036809
17065202	22-6069	12-713, 12-721	9252	7046725
17065203	22-6070	12-774	9252	7046725
17065204	22-6071	12-712, 12-722	9255	7046748
17065208	22-6072	—	9294	17054853

Carb. No.	Replacement		Power Kit	Overhaul Kit
	New	Rebuilt		
17065207	22-6073	—	9294	17052876
17065208	22-3179	—	9308	17053989
17065209	22-3180	—	9307	17053829
17065210	22-3181	12-810	9297	17052979
17065211	22-3182	—	9297	17052979
17065212	22-3183	—	9301	17053830
17065213	22-3184	12-816	9310	17055382
17065214	22-3185	—	9327	17055338
17065215	22-3186	—	9326	17055335
17065216	22-3187	—	9326	17055335
17065217	22-3188	—	9326	17055335
17065218	22-3189	—	9309	17054001
17065219	22-3190	—	9309	17054001
17065236	24-6079	—	9344	17055851
17065238	24-6080	—	9344	17055851
17065248	22-1224	—	9338	17065185
17065259	24-272	—	9346	17065244
17065267	22-6075	12-307, 12-308, 12-309	9087	—
17065268	22-3191	12-355, 12-358, 12-359	9148	—
17065269	22-3192	12-358, 12-359	9148	—
17065270	22-1225	12-514	9203	—
17065279	22-6083	12-325, 12-326, 12-327	9127	—
17065280	22-3193	12-506, 12-519, 12-650	9198	7041813
17065281	22-3194	—	9302	17055471
17065302	24-273	—	9346	17065301
17065304	21-3190	11-281, 11-536	9147	—
17065305	21-3191	11-350	9166	—
17065306	21-3192	—	9196	—
17065308	21-3193	11-469	9236	—
17065309	21-3194	11-470, 11-578	9248	—
17065310	21-3195	11-469	9248	—
17065311	21-3196	11-604	9248	—
17065312	21-3197	11-601	9248	—
17065500	24-3221	—	9371	17065434
17065501	24-3200	—	9370	17065410
17065503	24-3202	—	9370	17065407
17065504	24-3220	—	9371	17065434
17065505	24-3210	—	9370	17065410
17065506	24-3201	—	9370	17065410
17065507	24-3206	—	9389	17065686
17065508	24-3203	—	9370	17065926
17065509	24-3207	—	9389	17065686
17065510	24-3204	—	9370	17065410
17065511	24-3208	—	9389	17065686
17065512	24-3218	—	9389	17065713
17065513	21-3198	—	9347	17065392
17065514	21-3999	—	9347	17065392
17065515	24-3209	—	9389	17065686
17065516	24-3205	—	9370	17065407
17065517	24-3212	—	9389	17065686
17065518	22-3195	—	9368	17065400
17065519	22-3196	—	9368	17065400
17065520	22-3197	—	9368	17065400
17065521	22-3198	—	9368	17065400
17065522	22-3199	—	9389	17065404
17065523	22-3200	—	9389	17065404
17065524	22-3201	—	9389	17065404
17065525	22-3202	—	9389	17065404

USING CONVERSION TABLES

The following is an example of how a teacher might teach the skill of using a conversion table to a class:

"Many times in the field of mechanics you will be asked to make a measurement in inches and change that measurement to millimeters or vice versa. (Teacher gives some examples - shaft size - spark plugs, etc.) To make this kind of change (inches--millimeters or millimeters--inches), you will need to use a conversion table. The following exercise will help you learn to use a conversion table."

DEFINITION — A conversion table is a table that allows the student to determine the equivalence of one unit of measure to another.

PROCEDURE

Steps	Information/Activities
Teacher-directed scanning exercise	·Demonstrate the use of the chart (format, how to use structure, etc. ·Explain scanning skill (looking for particular items, etc.)
Student-oriented small group action	·Break students into small groups (3-5) ·Give each group 5-10 examples and ask them to make conversions from inches to millimeters and millimeters to inches.
Teacher-oriented wrap-up discussion	·Teachers using an overlay or the same chart should do 2 or 3 more examples.
Brief Test	·Using the conversion chart in front of them, students are directed to make 10 conversions (5 conversions inches--millimeters) (5 conversions millimeters--inches) (inches expressed both ways).

ENGLISH TO METRIC CONVERSION: LENGTH

To convert inches (ins.) to millimeters (mm): multiply number of inches by 25.4

To convert millimeters (mm) to inches (ins.): multiply number of millimeters by .04

Inches	Decimals	Millimeters	Inches to millimeters: inches	mm
1/64	0.015625	0.3969	0.0001	0.00254
1/32	0.03125	0.7937	0.0002	0.00508
3/64	0.046875	1.1906	0.0003	0.00762
1/16	0.0625	1.5875	0.0004	0.01016
5/64	0.078125	1.9844	0.0005	0.01270
3/32	0.09375	2.3812	0.0006	0.01524
7/64	0.109375	2.7781	0.0007	0.01778
1/8	0.125	3.1750	0.0008	0.02032
9/64	0.140625	3.5719	0.0009	0.02286
5/32	0.15625	3.9687	0.001	0.0254
11/64	0.171875	4.3656	0.002	0.0508
3/16	0.1875	4.7625	0.003	0.0762
13/64	0.203125	5.1594	0.004	0.1016
7/32	0.21875	5.5562	0.005	0.1270
15/64	0.234375	5.9531	0.006	0.1524
1/4	0.25	6.3500	0.007	0.1778
17/64	0.265625	6.7469	0.008	0.2032
9/32	0.28125	7.1437	0.009	0.2286
19/64	0.296875	7.5406	0.01	0.254
5/16	0.3125	7.9375	0.02	0.508
21/64	0.328125	8.3344	0.03	0.762
11/32	0.34375	8.7312	0.04	1.016
23/64	0.359375	9.1281	0.05	1.270
3/8	0.375	9.5250	0.06	1.524
25/64	0.390625	9.9219	0.07	1.778
13/32	0.40625	10.3187	0.08	2.032
27/64	0.421875	10.7156	0.09	2.286
7/16	0.4375	11.1125	0.1	2.54
29/64	0.453125	11.5094	0.2	5.08
15/32	0.46875	11.9062	0.3	7.62
31/64	0.484375	12.3031	0.4	10.16
1/2	0.5	12.7000	0.5	12.70
33/64	0.515625	13.0969	0.6	15.24
17/32	0.53125	13.4937	0.7	17.78
35/64	0.546875	13.8906	0.8	20.32
9/16	0.5625	14.2875	0.9	22.86
37/64	0.578125	14.6844	1	25.4
19/32	0.59375	15.0812	2	50.8
39/64	0.609375	15.4781	3	76.2
5/8	0.625	15.8750	4	101.6
41/64	0.640625	16.2719	5	127.0
21/32	0.65625	16.6687	6	152.4
43/64	0.671875	17.0656	7	177.8
11/16	0.6875	17.4625	8	203.2
45/64	0.703125	17.8594	9	228.6
23/32	0.71875	18.2562	10	254.0
47/64	0.734375	18.6531	11	279.4
3/4	0.75	19.0500	12	304.8
49/64	0.765625	19.4469	13	330.2
25/32	0.78125	19.8437	14	355.6
51/64	0.796875	20.2406	15	381.0
13/16	0.8125	20.6375	16	406.4
53/64	0.828125	21.0344	17	431.8
27/32	0.84375	21.4312	18	457.2
55/64	0.859375	21.8281	19	482.6
7/8	0.875	22.2250	20	508.0
57/64	0.890625	22.6219	21	533.4
29/32	0.90625	23.0187	22	558.8
59/64	0.921875	23.4156	23	584.2
15/16	0.9375	23.8125	24	609.6
61/64	0.953125	24.2094	25	635.0
31/32	0.96875	24.6062	26	660.4
63/64	0.984375	25.0031	27	690.6

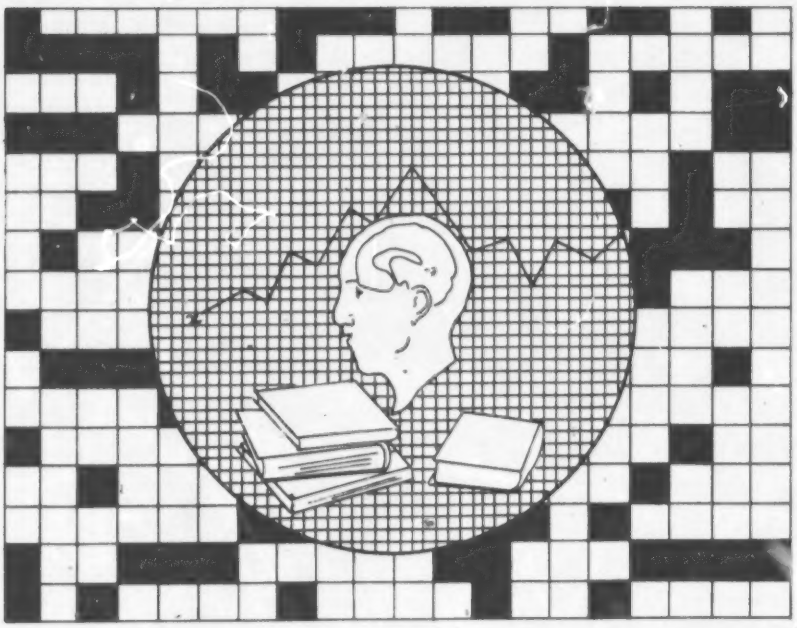
ENGLISH TO METRIC CONVERSION: TORQUE

To convert foot-pounds (ft. lbs.) to Newton-meters: multiply the number of ft. lbs. by 1.3

To convert inch-pounds (in. lbs.) to Newton-meters: multiply the number of in. lbs. by .11

in lbs	N-m	in lbs	N-m	in lbs	N-m	in lbs	N-m	in lbs	N-m
0.1	0.01	1	0.11	10	1.13	19	2.15	28	3.16
0.2	0.02	2	0.23	11	1.24	20	2.26	29	3.28
0.3	0.03	3	0.34	12	1.36	21	2.37	30	3.39
0.4	0.04	4	0.45	13	1.47	22	2.49	31	3.50
0.5	0.06	5	0.56	14	1.58	23	2.60	32	3.62
0.6	0.07	6	0.68	15	1.70	24	2.71	33	3.73
0.7	0.08	7	0.78	16	1.81	25	2.82	34	3.84
0.8	0.09	8	0.90	17	1.92	26	2.94	35	3.95
0.9	0.10	9	1.02	18	2.03	27	3.05	36	4.07

TOPIC: Learning: How Many Ways Are There?



INFORMATION: Students may have different learning styles. Having different kinds of activities facilitates learning.

- A Holistic Approach to Learning
- Whole Brain Activities
- Book List/Other Resources

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A HOLISTIC APPROACH TO LEARNING

COMMENTS

Present research shows that a more holistic approach to learning may develop a student's way of learning more fully. The left and right hemispheres of the brain work together, but also independently.

Our society and consequently our schools have used the left brain approach historically to the exclusion of more right brain learning.

DEFINITION ONE

Left brain is rational, logical, linear, verbal and convergent thinking.

DEFINITION TWO

Right brain is intuitive, sensory, holistic and divergent thinking.

EXAMPLE ONE

Left brain is logical and verbal like

- reading
- writing
- computing

EXAMPLE TWO

Right brain is intuitive and sensory like

- imagining
- drawing
- seeing

WHOLE BRAIN ACTIVITIES

COMMENTS

In your vocational classes, you have already used many hands-on sensory approaches to the learning of skills. The following list is just a beginning of some 50 ways of using whole brain activities for the Industrial Mechanics Vocational program. Any vocational program can utilize the list as a spring board by changing to the appropriate curriculum or tools of the trade.

EXAMPLE

Whole Brain Activities: Using All Senses and Mediums

1. Design a card, motorcycle, bike, etc., (any art media) i.e. watercolor, oil-collage, drawing-ink/pencil.
2. Take photos of cars, engines, cycles, for a Photo display.
3. Do a Film Strip about a car, engine, motorcycle, lawnmower, etc.
4. Design/Prepare an overhead overlay. Ex (basic block) etc.
5. Do an animated film on a car, cycle, engine, etc.
6. Write/compose a song about a car, engine, cycle, etc.
7. Make an auto, cycle model out of clay, wire, paper, etc.
8. Design a car of the future. (Any medium)
9. Find, illustrate the geometric shapes of an engine.
10. Measure engine parts - metric vs. non-metric. (Create a display - any medium).
11. Write a poem about a car, cycle, engine, part, etc.
12. Calligraphy a saying about a car, car slogan, a sales technique, etc.

WHOLE BRAIN ACTIVITIES - continued

13. Record/make a tape of sounds of a good vs. bad engine.

14. Make a cassette tape of the sounds of a cycle, car, lawnmower, tractor or combine various machines and engines - share w/class and see if they can tell what each sound represents.

15. Design a new part for car, cycle, bike from scrap/junk materials. Cut/build yourself.

17. Design an Electric car. (Any medium)

18. Make a model of a car, cycle, out of wood, pop sticks, plastics, metals, etc. Put in a kit - Design box.

19. Design a brochure of a car, auto, cycle, lawnmower.

20. Write an add for a newspaper, magazine, to sell a tool, car, cycle, project.

21. Do a poster on Car Safety. (Any medium)

22. Design/make a tool/engine holder.

23. Design and paint a wall mural in your shop.

24. Demonstrate volume by using different substances and containers.

25. Design/make a list in a creative way showing ways to save on gasoline.

26. Make/Design a shift knob for a car, tractor, etc. (Any medium)

27. Create a dance to the sounds of an engine, shop working.

28. Write an essay of songs that have used a car, cycle in the song title or verse. Example: Bicycle Built for Two, Little GTO, Round, Round, Get Around.

29. Trace the history of cars, cycles - Write or illustrate this history.

30. Design a flow chart on the function of gasoline in an engine or other project.

31. Class Project - Restore an antique car.

32. Design the various occupations in the Industrial Mechanics Vocational Cluster.

WHOLE BRAIN ACTIVITIES - continued

33. Design/Illustrate the different tools.

34. Create/Make a Video Tape on - Example - "How to do a tune-up".

35. Design a T-Shirt on cars, cycles, car symbols, or an Industrial Mechanic Project.

36. Design/Create a brand name of your own oil can.

37. Create/Illustrate color swatches for choices of paints/upholstery fabric.

38. Conduct a safety check on student cars.

39. Conduct a safety check on faculty cars.

40. Design a car, cycle, banner or flag. Hang these in your shop areas. Use different fabrics and mediums.

41. Make/design a book about a car.

42. Design a comic strip on a character and his car or cycle.

43. Write/produce a drama about cars, cycles, etc.

44. Design a pedal car/go cart with motor, etc.

45. Do a patch montage of cars/careers/tools on foam core.

46. Design a puzzle of a car scene, cycle scene. Make/paint finished product.

47. Create/design the prominent occupations in the Vocational Mechanics Cluster: 1) Auto Mechanic, 2) Aviation Mechanic, 3) Construction Equipment Mechanic, 4) Diesel Mechanic, 5) Hydraulics Mechanic, 6) Mill Wright, 7) Office Machines Mechanic, 8) Refrigeration Mechanic, 9) Small Engine Mechanic.

48. Design/draft a layout of an auto repair garage.

49. Write/design/illustrate an auto, cycle, bicycle manual.

50. Make/demonstrate the different types of welds.

51. Draw/design/photograph drawings, blueprints, electrical of tools or manuals for classroom use.

52. Design a VICA poster to recruit students to join.

WHOLE BRAIN ACTIVITIES - continued

53. Design/draw/illustrate overalls for shop use.

54. Have students visit shops and collect names and terms commonly used to identify mechanics tools and equipment. Draw/design a chart, board with these names on it.

55. Build a model of a car, cycle, mower out of scrap parts.

56. Design a vocabulary chart for blue print vocabulary, tools, etc.

57. Have a student plan, organize a field trip to local garages, engine rebuild shops, auto recyclers, car and cycle dealerships.

BOOK LIST/OTHER RESOURCES

EXAMPLE Other resources for whole brain learning

BOOK LIST/OTHER RESOURCES

THE CENTERING BOOK
Gay Hendricks
Thomas B. Roberts

THE SECOND CENTERING BOOK
Gay Hendricks
Thomas B. Roberts

THE FAMILY CENTERING BOOK
Gay Hendricks

THE CENTERED TEACHER
Gay Hendricks

SUPER-LEARNING
Sheila Ostrander
Lynn Schroeder

THE METAPHORIC MIND
Bob Samples

THE WHOLE SCHOOL BOOK
Bob Samples
Cheryl Charles
Dick Barnhart

EXPERIENCES IN VISUAL THINKING
Robert McKim

DRAWING ON THE RIGHT SIDE OF THE BRAIN
Betty Edwards

100 WAYS TO ENHANCE SELF CONTROL
Jack Canfield
Harold Wells

MOVIES: UNIVERSAL LANGUAGE
Sister Bede Sullivan

ILLUSIONS
Richard Bach

OPENING
Bob Samples

FREEDOM TO LEARN
Carl Rogers

POWERS OF THE MIND
Adam Smith

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